Optical Line Filter and Spectrometer based Upon Two-Photon Absorption for Doppler LIDAR at 1.053 um, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

A receiver system for use in LIDAR consisting of an optical filter and optical spectrometer based upon two-photon absorption is proposed. The filter and spectrometer both use dispersion from excited state transitions of atomic rubidium to create a birefringent medium. The birefringent medium of the optical filter rotates the polarization of light so that it is transmitted through crossed polarizers. The birefringent medium of the spectrometer rotates the polarization of light an amount dependent upon frequency so that Doppler shift can be determined. The wavelength of operation is at 1.530 um which coincides with both the H atmospheric transmission band, and high power C-band transmitters. Since the spectrometer utilizes dispersion rather than absorption to determine frequency, there is no absorption line attenuation of the signal. With a high performance filter and spectrometer, the principle disadvantage of direct detection compared to coherent detection is mitigated. The strength of this method is that superior spatial resolution of wind, on the order of a decade, is attainable compared to coherent detection. Operating at an eye-safe wavelength, a LIDAR using the proposed receiver would bring increased detection capability of wind shear and turbulence.

Anticipated Benefits

1. High spatial resolution, eye-safe Doppler LIDAR

2. Aerosol LIDAR

1. Turbulence detection.

2. Optical filtering for line associated with excited state transitions in alkeli metals.

3. Aerosol LIDAR

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

EspyLux LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Continued on following page.

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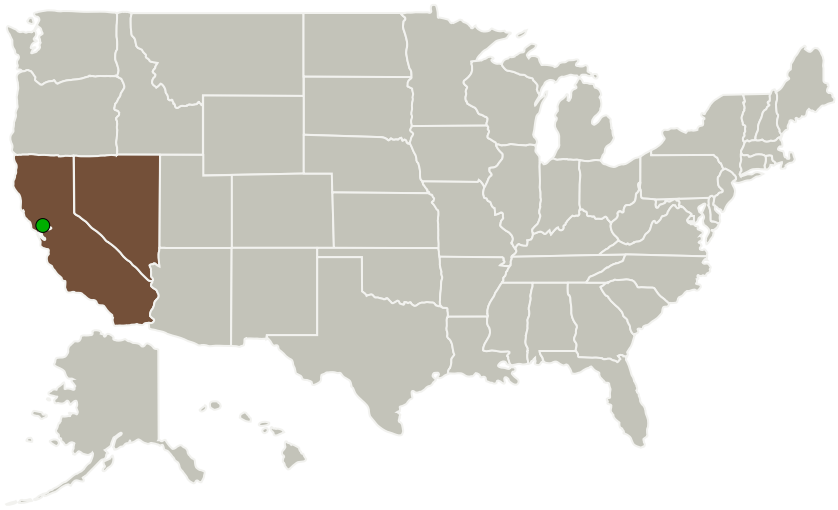
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
EspyLux LLC	Lead Organization	Industry Small Disadvantaged Business (SDB)	Reno, Nevada
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Nevada

Project Transitions

July 2018: Project Start

Project Management *(cont.)*

Program Manager:

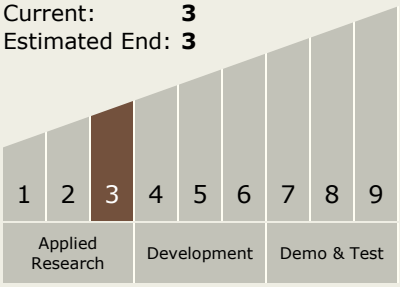
Carlos Torrez

Principal Investigator:

Joseph D Vance

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destination

Earth

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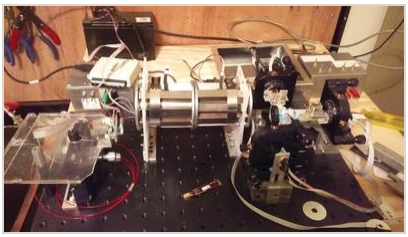
February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141220)*

Images

Briefing Chart Image
Optical Line Filter and Spectrometer based Upon Two-Photon Absorption for Doppler LIDAR at 1.053 um, Phase I
(https://techport.nasa.gov/image/126326)



Final Summary Chart Image
Optical Line Filter and Spectrometer based Upon Two-Photon Absorption for Doppler LIDAR at 1.053 um, Phase I
(https://techport.nasa.gov/image/125782)